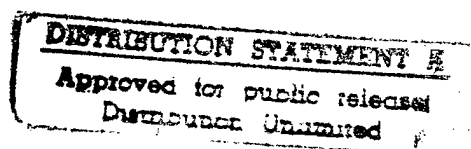


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Inventor Neil J. Dubois

NOTICE

The above identified patent application is available for licensing. Requests for information should be addressed to:

OFFICE OF NAVAL RESEARCH  
DEPARTMENT OF THE NAVY  
CODE OCCC3  
ARLINGTON VA 22217-5660



19960823 101

1 Navy Case No. 77242

2  
3 A COOLED FIXTURE FOR HIGH  
4 TEMPERATURE ACCELEROMETER MEASUREMENTS

5  
6 STATEMENT OF GOVERNMENT INTEREST

7 The invention described herein may be manufactured and used  
8 by or for the Government of the United States of America for  
9 governmental purposes without the payment of any royalties  
10 thereon or therefor.

11  
12 BACKGROUND OF THE INVENTION

13 (1) Field of the Invention

14 The present invention relates to a device for measuring the  
15 acceleration of or vibrations created by a fluid travelling  
16 through a conduit such as a high temperature steam pipe.

17 (2) Description of the Prior Art

18 Sensors are used for a variety of technical applications  
19 for measuring and monitoring purposes. In many applications, the  
20 sensors are required to operate in high temperature environments.  
21 U.S. Patent No. 3,791,203 to Rice illustrates a pair of  
22 accelerometers, used in a hot environment, for measuring the  
23 torsional vibration of a rotating horizontal shaft. One of the  
24 problems with the Rice accelerometer arrangement is that there is  
25 no provision to cool the accelerometers. As a result, the  
26 sensors are subject to heat damage.

1 U.S. Patent No. 5,241,262 to Guthrie et al. illustrates a  
2 molten metal inclusion sensor for use in the testing of steel.  
3 The sensor comprises a probe which is detachably connected to a  
4 water-cooled support member. Still another sensor which is  
5 provided with cooling is shown in U.S. Patent No. 3,171,989 to  
6 Hatschek. The Hatschek sensor is a pressure sensor for use in  
7 internal combustion engines. Cooling is provided by cooling the  
8 sensor elements themselves with highly viscous, high heat  
9 capacity cooling fluids.

10 U.S. Patent No. 3,536,939 to Zeiringer and U.S. Patent No.  
11 3,614,487 to Hatschek both teach the use of a base plate for an  
12 accelerometer which contains open channels cut into a bottom  
13 surface. The channels serve two purposes. First, they reduce  
14 the area in contact with any hot mounting surface, thereby  
15 reducing the heat flux across the interface and into the  
16 accelerometer. They also allow for some volume of air to flow  
17 therethrough and provide a modicum of free convection cooling to  
18 the accelerometer base plate.

19 The production of high temperature, high pressure steam  
20 creates substantial energy and vibration in a steam plant and  
21 piping. It is required to quantify the vibration in the steam  
22 piping since the steam is being used to drive a propulsion system  
23 which will be subjected to noise measurements. The contribution  
24 to the overall noise from the steam delivery system is a critical  
25 piece of information in the determination of noise contributed by  
26 the propulsion system. Unfortunately, steam pipes have

1 temperatures in excess of 1000°F. Accelerometers, even high  
2 temperature models, do not have the capacity to perform in  
3 regions above about 350°F. Some means is required to make the  
4 needed measurement while keeping the accelerometer acceptably  
5 cool.

6 While some of the aforementioned patents show sensors with  
7 some form of cooling, none of them show the concept of providing  
8 active, forced convection cooling to the media on which the  
9 accelerometer is mounted. The inventor has found that such a  
10 design is of paramount importance in a device which is designed  
11 to measure vibrations of high temperature superheated steam  
12 pipes. In such environments, the wall temperatures of the pipe  
13 to which the sensor is mounted can be as high as 1200 to 1500°F.  
14 Simple air flow across the base plate could not provide the  
15 necessary cooling for the sensor. Additionally, one faces the  
16 problem that steam pipes must be insulated to prevent  
17 condensation of the steam. Thus, any sensor that is mounted to  
18 the steam pipe will be surrounded by thermal insulation, which  
19 prevents any air flow from occurring in the sensor mounting area.  
20

#### 21 SUMMARY OF THE INVENTION

22 Accordingly, it is an object of the present invention to  
23 provide an improved device mounted to a steam pipe for measuring  
24 the acceleration of or the vibrations caused by a fluid flowing  
25 through the pipe.

1           It is a further object of the present invention to provide a  
2 device as above which has an active, forced convection cooling  
3 system which allows survival of the sensor.

4           It is a further object of the present invention to provide a  
5 device as above which is easy to install and remove.

6           The foregoing objects are attained by the device of the  
7 present invention.

8           In accordance with the present invention, a device for  
9 measuring the acceleration of or the vibrations created by a  
10 fluid, such as high temperature steam, travelling through a  
11 conduit or a pipe comprises means for mounting at least one  
12 accelerometer to the pipe and means for controlling the  
13 temperature of the accelerometer associated with the mounting  
14 means. In a preferred embodiment, the mounting means comprises a  
15 ring collar which clamps around the pipe and a block joined to  
16 the collar. Mounting points for one or more accelerometers are  
17 provided at or near a top surface of the block. The temperature  
18 control means preferably comprises a passageway in the block  
19 through which a cooling media is circulated to keep the top of  
20 the block cool.

21  
22                           BRIEF DESCRIPTION OF THE DRAWINGS

23           Other details of the device of the present invention, as  
24 well as other objects and advantages to the invention, will  
25 become apparent from the following detailed description and the

1 accompanying drawings wherein like reference numerals depict like  
2 elements.

3 FIG. 1 is a partial sectional view of a high temperature  
4 steam pipe to which the device of the present invention has been  
5 mounted;

6 FIG. 2 is a side view of the device of the present invention  
7 in partial cross-section; and

8 FIG. 3 is a perspective view of the device of the present  
9 invention as affixed to a steam pipe.

10  
11 DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

12 Referring now to FIGS. 1-3, the device 10 of the present  
13 invention includes a ring collar 12 which clamps around a steam  
14 pipe 13 or other hot pipe. The outer wall 14 of the pipe 13 may  
15 be insulated or uninsulated. As previously discussed, typically  
16 the pipe 13 will be insulated. The ring collar 12 has two semi-  
17 cylindrical segments 16 and 18 which are connected together by  
18 bolt assemblies 20 and 22 in any known manner so as to grab the  
19 pipe 13 firmly and thereby not affect the quality of the  
20 acceleration or vibration measurement. Bolt assemblies 20 and 22  
21 can be replaced by other fastening devices well known in the art.

22 A block 24 is welded to one of the segments 16 and 18.  
23 Preferably, the block 24 is welded to the top of the uppermost  
24 ring segment 16. The block 24 is formed from stainless steel or  
25 some other material similar to the material forming the pipe so  
26 as to withstand the high temperatures involved.

1           The block 24 has a plurality of mounting points 26 for  
2 attaching one or more accelerometers 28 to the block. The  
3 mounting points 26 are preferably threaded bores, although other  
4 types of mounting arrangements can be used. The mounting points  
5 26 are spaced about the periphery of the block 24, preferably at  
6 or near the top surface 25 of the block 24.

7           The block 24 is provided with a cooling system 30 to  
8 maintain the temperature at a level where accelerometers 28 can  
9 survive. The cooling system 30 comprises a passageway 32  
10 machined into the block 24, which passageway terminates in  
11 opposed threaded bores 34. A fluid fitting 36 is threaded into  
12 each bore 34. One of the fluid fittings 36 is connected to a  
13 source (not shown) of cooling fluid via a fluid line 38 and the  
14 other fluid fitting 36 is connected to a fluid sump (not shown)  
15 via a fluid line 40.

16           The accelerometer mounting device of the present invention  
17 may be used with any suitable accelerometer known in the art for  
18 measuring accelerations or vibrations caused by a fluid such as  
19 steam flowing through a very high temperature pipe. The device  
20 of the present invention allows the accelerometers 28 attached to  
21 the device to survive in situations where they would not survive  
22 if fastened directly to the pipe 13. The device of the present  
23 invention is easy to install and remove. It can be used anywhere  
24 there is a free section of pipe to which it can be attached.

25           While the present invention has been described in the  
26 context of mounting accelerometers to a pipe, it should be

1 recognized that the device may be used to mount other types of  
2 sensors to a pipe.

3 It is apparent that there has been provided in accordance  
4 with the present invention a cooled fixture for high temperature  
5 accelerometer measurements which fully satisfies the means,  
6 objects and advantages set forth hereinbefore. While the  
7 invention has been described in combination with specific  
8 embodiments thereof, it is evident that many alternatives,  
9 modifications and variations will be apparent to those skilled in  
10 the art in light of the foregoing description. Accordingly, it  
11 is intended to embrace all such alternatives, modifications, and  
12 variations,  
13



1 Navy Case No. 77424

2  
3 A COOLED FIXTURE FOR HIGH  
4 TEMPERATURE ACCELEROMETER MEASUREMENTS

5  
6 ABSTRACT OF THE DISCLOSURE

7 The present invention related to a cooled fixture for high  
8 temperature accelerometer measurement. The fixture includes a  
9 collar mounted to a pipe and a block mounted to the collar to  
10 which one or more accelerometers may be connected. The block is  
11 provided with a cooling system for controlling the temperature of  
12 the accelerometer(s) mounted to the block and maintaining the  
13 temperature at a level at which the accelerometers will survive.

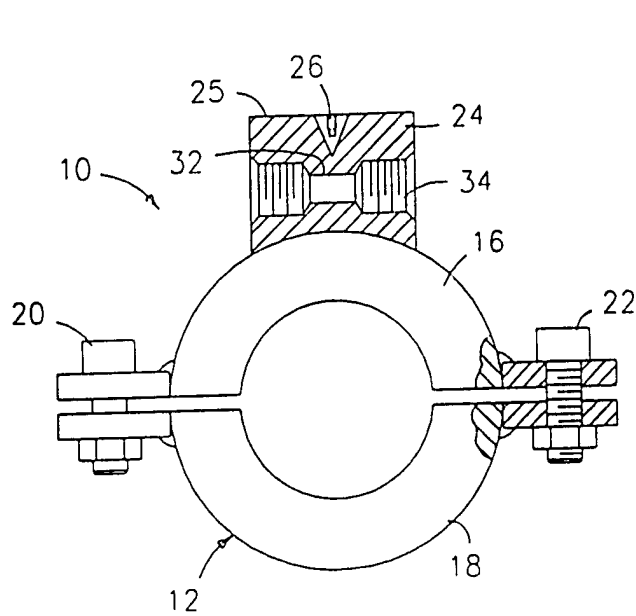


FIG. 1

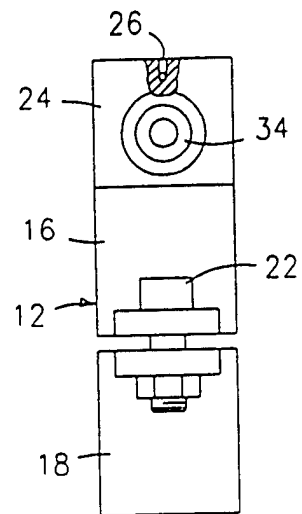


FIG. 2

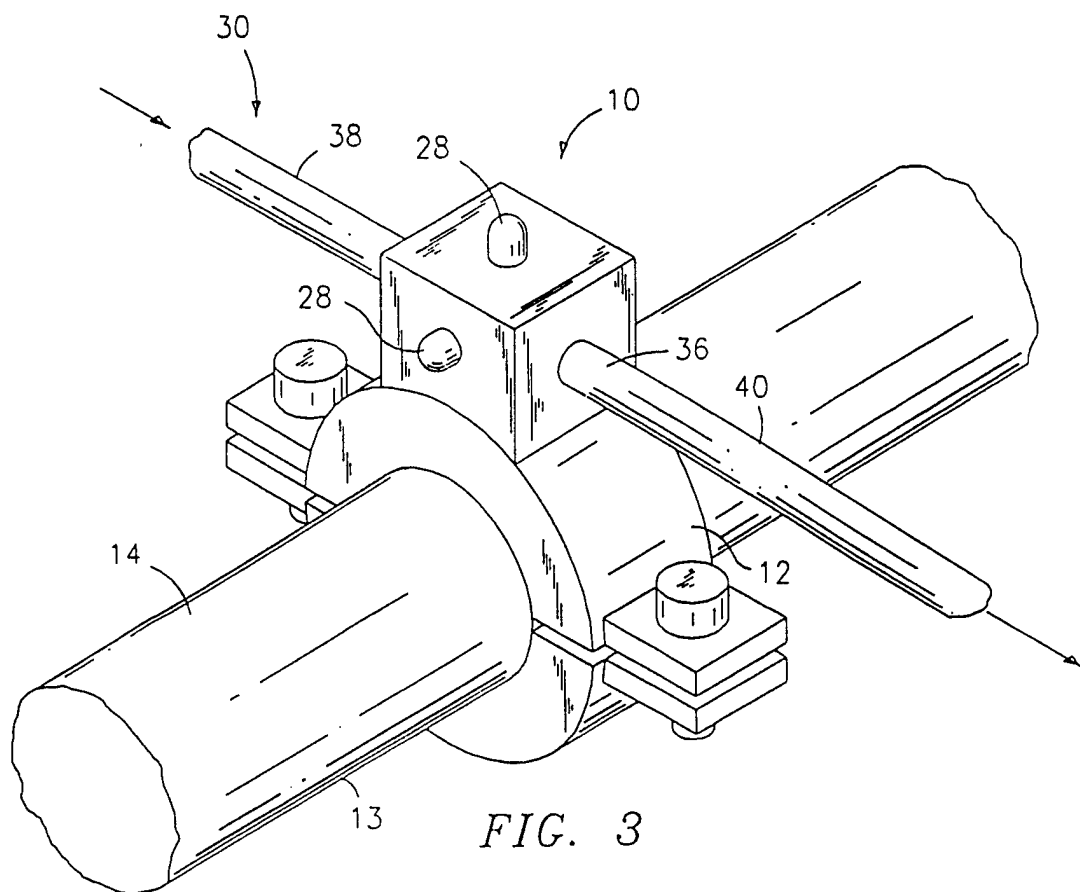


FIG. 3